AMENDMENTS TO THE SPECIFICATION:

Please amend the paragraph beginning on page 2, line 5, as follows:

A data detecting method called Partial Response Maximum Likelihood (PRML) is known as a reproducing method which can further increase the density by using a conventional equalizing method. In PRML, reproduced signals are equalized to a predetermined partial response (may be abbreviated as PR, hereinafter) waveform having inter-code interference. The influence of the inter-code interference is considered based on an algorithm called Viterbi decoding to perform data identification. Some kinds of inter-code interference regulated in partial responses equalize waveforms having inter-code interference to acceptable waveforms. Thus, the noise increase due to [[the]] equalization can be suppressed. Since the influence by the inter-code interference is considered by [[the]] Viterbi decoding, a higher recording density can be achieved.

Please amend the paragraph beginning at page 2, line 17, as follows:

A time length (time T in clock unit in Fig. 3) in bit rate having a non-zero (0) value in a partial response waveform is generally called constraint length. Fig. 3 shows a partial response waveform having constraint length 4 as a waveform example. A longer constraint length means a reproduced waveform having higher inter-code interference. When data is recorded in high density, the signals to be actually read have high inter-code interference. Therefore, a partial response waveform having a longer constraint length is selected. As a result, due to the linear superimposition (superimposition computing) of partial response waveforms, reproduced signals can be obtained which are close to the actual reproduced signals. When the actual reproduced waveform is less different from the waveform represented by the superimposition

HAYES SOLOWAY P.C.
3450 E. SUNRISE DRIVE,
SUITE 140
TUCSON, AZ 85718
TEL. 520.882.7623
FAX. 520.882.7643

175 CANAL STREET
MANCHESTER, NH 03101
TEL. 603.668.1400
FAX. 603.668.8567

computing of the partial response waveform, the noise amplification due to [[the]] equalization can be suppressed.

Please amend the paragraph beginning at page 3, line 8. as follows:

This is due to changes in reproduced signals. In order to equalize reproduced signals to a partial response waveform, a finite impulse response (FIR) filter is used which generally includes about 5 to 20 taps. A change in tap coefficient of the filter changes the equalized signal. Here, [[the]] equalization can be performed by using a predetermined and fixed tap coefficient. However, the reproduced signals even with the same recording density depend on the beam diameter of an optical head for reproducing, the inclination of an optical information medium and/or the like.

Please amend the paragraph beginning at page 3, line 16, as follows:

A technology called adaptive equalization is known as one technique for changing the tap coefficient in accordance with the change in reproduced signals. In [[the]] adaptive equalization, a properly predetermined tap coefficient is used as an initial value. Then, the tap coefficient is changed gradually such that the difference between an equalized waveform and a target waveform based on the initial value can be the smallest in the shortest time. By performing convergence calculations with different tap coefficients, the most suitable tap coefficient is obtained. Advantageously, equalization can be performed even when data recorded in information is not known in this technique. However, [[the]] equalization is susceptible to noise, for example, and the convergence calculations do not converge but diverge, which is a problem. Especially, when the recording density is high and when the signal quality of reproduced signals is low, the problem becomes more significant.

Please amend the paragraph beginning at page 4, line 18, as follows:

HAYES SOLOWAY P.C.
3450 E. SUNRISE DRIVE,
SUITE 140
TUCSON, AZ 85718
TEL. 520.882.7623
FAX. 520.882.7643

175 CANAL STREET
MANCHESTER, NH 03101
TEL. 603.668.1400
FAX. 603.668.8567

The number of the sampled waveform data is desirably 3000 or more. The reproduced signal equalizing method may further ~~includes~~ include the steps of inputting the reproduced signals sampled in the predetermined cycle to a Viterbi decoder, and defining a target waveform as a waveform resulting from equalization of the reproduced signals based on binarized data demodulated by the Viterbi decoder and the partial response waveforms. In particular, a partial response value (1,2,2,2,1) is desirably used as the target partial response waveform.

Please amend the paragraph beginning at page 6, line 13, as follows:

In order to achieve the objects, an equalizing method for equalizing reproduced signals to a partial response waveform in a stable manner includes ~~[steps of]~~ the steps of sampling reproduced signals in a predetermined cycle, calculating an equalization coefficient for producing the smallest difference between a target waveform and an equalized waveform by the least square technique by using a predetermined number or more of sampled waveform data, and equalizing the reproduced signals by using the calculated equalization coefficient.

Please amend the paragraph beginning at page 6, line 27, as follows:

In an optical information reproducing apparatus shown in Fig. 2, signals recorded on an optical information medium, that is, an optical disk (not shown) are read as analog signals through an optical head device (not shown). The analog signals are amplified to analog reproduced signals having a sufficiently large amplitude by an amplifier 11. Then, the analog reproduced signals are digitally converted by an analog/digital (A/D) converter 12. The digitally converted reproduced signals are output as digital reproduced signals y_k at bit rate, that is, in clock time by a phase-locked loop (PLL) circuit. Then, the reproduced signals y_k are input to an equalizer 13. The reproduced signals y_k are equalized to a predetermined PR

HAYES SOLOWAY P.C.
3450 E. SUNRISE DRIVE,
SUITE 140
TUCSON, AZ 85718
TEL. 520.882.7623
FAX. 520.882.7643

175 CANAL STREET
MANCHESTER, NH 03101
TEL. 603.668.1400
FAX. 603.668.8567

waveform by the equalizer 13 and are input to a Viterbi decoder 14. The Viterbi decoder 14 binarizes the data by the Viterbi algorithm.

Please amend the paragraph beginning at page 8, line 17, as follows:

According to the invention, unlike [[the]] adaptive equalization, information recorded on an optical disk must be known in advance. However, it is difficult to know data previously recorded on an optical disk such as a read-only memory (ROM). The inventors found that even data resulting from the direct binarization of unequalized waveforms by using a Viterbi decoder could be equalized more precisely with a predetermined number of samples.

Please amend the paragraph beginning at page 9, line 19, as follows:

The phase-change optical disk was provided on a polycarbonate substrate 0.6 mm thick. The pitch of a guide slot on the substrate was 0.68 μm. Data a_k modulated by (1-7) modulation method was written thereon and then was read by using an optical head having a wavelength of 405 nm and an objective lens with an NA of 0.65 under a condition with a linear speed of 5.6 m/s and a clock frequency of 64.6 MHz. The recording density was 0.13 μm/bit. In Example 1, as shown in Fig. 1, [[the]] equalization by the least square technique used provisional binary data b_k obtained by directly inputting unequalized reproduced signals y_k for each clock time to the Viterbi decoder 3. In Example 1, the target partial response waveform had a PR value (1,2,2,2,1).

Please amend the paragraph beginning at page 10, line 1, as follows:

The partial response equalization was performed with the different numbers of samples of the reproduced signal y_k to be used for the least square technique. Then, the binary data "c_k" and "a_k" demodulated by the Viterbi decoder 3 were compared, and the bit error rate was finally calculated. The FIR filter 6 having 9 taps was used for [[the]] equalization. 10^6 samples were

HAYES SOLOWAY P.C.
3450 E. SUNRISE DRIVE,
SUITE 140
TUCSON, AZ 85718
TEL. 520.882.7623
FAX. 520.882.7643

175 CANAL STREET
MANCHESTER, NH 03101
TEL. 603.668.1400
FAX. 603.668.8567

used for calculating the error rate. However, for example, when the first 100 reproduced signal samples of the 10^6 samples were used to calculate an equalization coefficient by the least square technique, all of the 10^6 reproduced signal samples were equalized with the equalization coefficient. Then, the signals were input by the Viterbi decoder 3, and "c_k" of the binary data was calculated.

Please amend the paragraph beginning at page 10, line 24, as follows:

The ROM disk was provided on a polycarbonate substrate 0.6 mm thick. Known data a_k was formed on the substrate. Here, the radial pitch of the pit was 0.4 μm and the pitch in the laser scanning direction was 0.2 μm. Since the (1-7) modulation method was used to form the pit, the linear density was 0.15 μm/bit. By using an optical head having a waveform of 405 nm and an objective lens with a NA of 0.65, a reproducing evaluation was performed at a linear speed of 6.6 m/s. Also in this example, like Example 1 and as shown in Fig. 3, [[the]] equalization by the least square technique used provisional binary data b_k obtained by directly inputting reproduced signals y_k in clock time to the Viterbi decoder 3. The FIR filter 6 with 9 taps was used for [[the]] equalization, and the target partial response waveform was the PR value (1,2,2,2,1).

Please amend the paragraph beginning at page 11, line 23, as follows:

In Example 1 and Example 2, the provisional binary data b_k was calculated by inputting sampled reproduced signals to the Viterbi decoder 3 without [[the]] equalization of the reproduced signals. However, the provisional binary data may be calculated by inputting signals equalized with a proper predetermined equalization coefficient to the Viterbi decoder 3.

Please amend the paragraph beginning at page 15, line 20, as follows:

HAYES SOLOWAY P.C.
3450 E. SUNRISE DRIVE,
SUITE 140
TUCSON, AZ 85718
TEL. 520.882.7623
FAX. 520.882.7643

175 CANAL STREET
MANCHESTER, NH 03101
TEL. 603.668.1400
FAX. 603.668.8567

The set value of the recorded waveform can repeatedly be corrected. That is, based on the recorded waveform set value corrected, the recorded waveform is generated from binary recorded data. After that, according to [[such]] the steps as described above, the quality evaluation value of the reproduced signals is calculated. And based on the calculated quality evaluation value, the recorded waveform set value stored in the internal memory of the recorded waveform generator 33 is corrected.

Please amend the paragraph beginning at page 15 line 27, as follows:

In the case that the set value of the recorded waveform can repeatedly be corrected, the tap coefficient obtained at the first time may be used for calculation on and after the second. As the result, since the calculation time on and after the second for the tap coefficient is omitted, the correction of the set value of the recorded waveform is performed at high speed.

HAYES SOLOWAY P.C.
3450 E. SUNRISE DRIVE,
SUITE 140
TUCSON, AZ 85718
TEL. 520.882.7623
FAX. 520.882.7643

175 CANAL STREET
MANCHESTER, NH 03101
TEL. 603.668.1400
FAX. 603.668.8567